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Britain's Shale Gas Zeal and Riches

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Abstract. *The United Kingdom is considered to be shale gas rich with substantial volumes distributed both onshore and offshore. Recent technological development has made shale gas exploration commercially viable. The UK's shale gas industry is at an early stage, with a few companies actively operating in this area and merely a few specific regulations exist for it. Many questions are waiting to be answered, many barriers must be overcome. This article analyses the UK's current state of play for shale gas. First, background information and a brief description of shale gas hydraulic fracturing is given. Government and business points of view will be illustrated and analysed before offering an outlook.*

Keywords: Cuadrilla Resources, energy, energy policy, fracking, hydraulic fracturing, iGas, natural gas, shale gas, unconventional gas, United Kingdom

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Introduction

The UK's first well to encounter shale gas was drilled in 1875, but for a century that was a marginal topic in the energy industry. Once serious shale gas exploration began in the United States in the 1980s, scientific efforts started to evaluate the UK potential. Research identified several shale gas reservoirs. Without any government encouragement for shale gas for exploration and production (E&P), this resulted in no major publications nor industrial activity. Even the Department of Energy's petroleum resources reports 2001 and 2003 omitted shale gas resources. Neglect continued until the late 2000s.

With America's growing maturity of technology and significant success, the UK began to reconsider. The UK government gradually changed its attitude from inactive to active, encouraging shale gas exploration. Timely evaluations of shale gas in the UK are carried out by the British Geological Survey and the Department for Energy & Climate Change (Selley, 2012). The 13th Onshore Licensing Round was run in 2008 and consent was given to drill for shale gas in five locations. The first well, built by Cuadrilla Resources, was drilled to specifically test for shale gas in August 2010 (Richards, 2012). With significant deposits in the North West, the East Midlands, Wessex and Scotland, the UK is considered to be shale gas rich (Shale Gas Group Europe, n.d.). The British Geological Survey (BGS) estimated in 2013 there might be 1,300 to 1,700 trillion cubic feet of gas locked onshore, a dramatic increase compared to earlier 2010 BGS data, stating only 5.3 trillion cubic feet. With estimates 200 times higher, the mood towards shale gas switched from moderate to enthusiastic (Webb, Sylvester, & Thomson, 2013).

The UK is a big gas-consuming country. Natural gas forms a key part of energy supply. In 2009, gas generated almost half of UK electricity and fuelled the majority of residential heating. Domestic gas production peaked in 2000. A growing part of gas supply is now imported; import share reached 32 percent in 2009. Consequently, concern about energy sustainability and security is rising, increasing discussion about using clean energy to achieve UK greenhouse gas emission-reduction targets as gas produces half of the emission as coal (The Parliamentary Office of Science and Technology, 2011).

However, shale gas development in the UK is still at an early stage. There is a notable lack of information and experience in prospecting. As the geographic distribution of shale reservoirs is much more fragmented and complicated than in the US, exploiting the fields is likely to be much harder, and economics are still unclear. Currently, few firms are actively exploring shale gas, with Cuadrilla Resources in the lead.

It is also necessary for the UK government to look at their regulatory regime. The hydraulic fracturing technique fuels concerns about seismicity, as some earth tremors happened near exploration fields in 2011 (Richards, 2012). Furthermore, hydraulic fracturing adds to environmental concerns, such as surface and groundwater pollution.

Nevertheless, with tremendous storage under the feet of UK, the door to shale gas exploration and production has already opened. It will bring, or has already brought, a series of effects on the government policy, business and environment level.

The British State of Play

Government policy: active encouragement

The UK government's current policy is actively encouraging the development of shale gas. On the one hand, the government regards shale gas as a "game changer" (Haug, 2013) that is likely to play an important role in the sustainable development of the energy industry as well as the UK's energy security within the next decades. On the other hand, the government is working hard

to meet its greenhouse gas emission-reduction target. As one observer states, "political hopes for Britain's low carbon clean-tech energy policy are now firmly locked to finding and extracting shale gas" (Garrett, 2013, p. 39). The UK's hope to replicate the US shale gas boom is obvious (Petroff, 2013).

Consequently, within Europe, the UK stands very active, just after Poland, in pursuing its shale gas and shale oil potential. Political opposition to shale development in UK is greater than in Poland but less than in France or Germany (U.S. Energy Information Administration, 2013).

In the recent government budget, finance minister George Osborne promised tax breaks and cash incentives for companies undertaking test drilling of shale gas and for communities which consent to drilling in their areas (Garrett, 2013).

The reality of shale gas in the UK should still be considered carefully. In general, Britain has limited domestic service sectors and capabilities for exploration, deposits are more fragmented and geologic conditions are complicated. Among other things, shale gas wells are costly to drill (U.S. Energy Information Administration, 2013). Even though the government pursues a push strategy, a stable and mature shale gas industry has not yet established itself, and whether E&P is able to reach and maintain a commercial level is unclear. Furthermore, only strategic policies are not enough. Regulating the new industry is crucial.

Basically, the purpose of a regulatory regime is to ensure sound development of a specific industry, which means a balance between the strategic push and environmental and safety issues fracking may cause. Shale gas drilling is covered by the normal regime for all oil and gas exploration and development activities. A Petroleum Exploration and Development License (PEDL) is needed for company to do gas exploration activities including exploration and development of unconventional onshore gas (Richards, 2012).The Crown, through the Department of Energy and Climate Change and the Coal Authority, provides these licenses, as mineral rights are owned by the Crown rather than by the landowner in the UK (The Parliamentary Office of Science and Technology, 2011). But landowner permission is necessary after the licensee has identified a location within their PEDL (Bryden, 2013). The company then needs to obtain planning permission from the local authority as well as approvals, which usually for the chemicals used in fracking operations, is from the Environment Agency and the Health and Safety Executive.

The last Onshore Licensing Round took place in 2008. Planning permission and consent of drilling shale gas was given to five locations. Cuadrilla Recourses obtained consent for shale fracking at two sites. In addition, a number of companies that had been awarded licenses in earlier offshore rounds are re-assessing the shale potential of older licenses (Richards, 2012).

Although recognized by many national politicians, some operators claim that the framework of this regulatory regime is still confusing. The Institute of Directors (IoD), a business interest group, criticized a lack of guidance and clarification in the planning and permitting regime. That could be a major barrier to development. The government is now working to revise the permission process. "We want to streamline, simplify, but also to make sure that we don't miss anything," the newly-created Office for Unconventional Gas and Oil stated (Natural Gas Europe, 2013).

Monitoring and controlling of drilling wells in the UK can be subjected to a "traffic light" system. Seismic monitoring accompany the E&P process, so if tremors are above a certain level, drilling is halted, pending investigation. Fracking chemicals have to be disclosed and approved by the Environment Agency and the Health and Safety Executive (Harvey & Vaughan, 2012).

In April and May 2011, two earth tremors occurred near an exploration field in the North-West. Government suspended test drilling, and issued a one-year moratorium. Even though the BGS notes that risks of shale gas development to groundwater and earthquakes have been exaggerated, the Royal Society and Royal Academy of Engineering conducted a risk review. They recommend groundwater monitory, well integrity and mitigating seismicity as three primary steps for ensuring health and safety during the shale development. In December 2012, the government gave green light to fracking again. A new regulatory regime was launched at the same time, requiring operators to evaluate seismic hazards from fracking, and implement seismic monitoring of every well site area, and propose risk mitigation measures (U.S. Energy Information Administration, 2013). Now, drilling is expected to be safer, but much more costly and time consuming. Environmental groups still hold contrary views. Greenpeace UK has argued that it was not a wise decision to start the industry unprepared, without full investigation and understanding the impact of chemicals and fracking technology (Lynas & Santillo, 2012).

In a joint statement on fracking from Food & Water Europe, Friends of the Earth Europe, Greenpeace and Health & Environment Alliance, fraking is regarded as a "high-risky activity" without a comprehensive scientific assessment and a sufficient shale-gas related decision making process, which means citizens and communities who directed impacted by the fracking are not properly included in this process. They believe that no further shale gas activities should proceed. (Food & Water Europe, Friends of the Earth Europe, Greenpeace, Health & Environment Alliance, 2012).

Business finds the new rules more satisfying. Cuadrilla Recources' CEO Francis Egan said, "It is recognized that the UK regulatory regime is if not the best, up there with the best in the world." Compared to US, British rules are far stricter for higher safety and environment standards, avoiding reckless mistakes earlier committed in the US (Werth, 2013). Yet, criticisms stems partly from Britain's dominant history of offshore gas E&P. Onshore operations are conducted under rules designed mostly for offshore drilling, neglecting some obvious differences. The Health and Safety Executive did inspect on Cuadrilla Resources' test wells two years ago, but the visit was mostly to check worker safety and well integrity assessment, relying strongly on company information (ibid, 2013).

To sum up, the UK government shows a strong intention to push shale gas development. Strategic policies are made to actively encourage the industry. A stricter, concise and effective regulatory regime is in the making which both promotes industry but also protects the environment. On the implementation side, this regime seems relatively weak and overly dependent on the companies.

Business: almost a single-player market

Big oil and gas companies have not shown, at least in public, much interest or enthusiasm for shale gas. This limited interest was underpinned, for example, by BP chief economist Cristof Ruhl and British Gas CEO Sam Laidlaw describing, contrary to the government's opinion, the potential of shale gas in the UK as not being a "game-changer" (Griffith, 2013). But then, British Gas owner Centrica bought a 25percent stake of Cuadrilla Resources (Gosden, 2013).

Cuadrilla, formed in 2007, is considered the only big player in the UK's shale gas industry. Rival iGas is smaller, and the rest are only fringe players (Griffith, 2013). A bigger rival emerged in autumn 2013 when Australian firm Dart Energy and French gas giant GDF Suez joined forces, preparing to drill by 2015 (Mainwaring, 2013).

The reasons for Cuadrilla's initial stand-alone position are diverse. Cuadrilla owns a Petroleum Exploration and Development License for the Bowland Basin between Blackpool and Preston

in Lancashire (ibid, 2013). This part of the UK is not only famous for farming and tourism, but also for the area where Cuadrilla drilled Britain's first exploratory wells and applied hydraulic fracturing (Werth, 2013). According to the company's own estimate, there are more than 200, perhaps up to 300 trillion cubic feet of gas to be found under Lancashire. By contrast, Dart Energy has Bowland Basin licenses for deposits believed to be at 110 trillion cubic feet (Mainwaring, 2013).The British Geological Survey (BGS) report stated that the UK in total might actually have at least 1,300 trillion cubic feet of shale gas in their grounds, so Cuadrilla's share is big by any standard. The Department for Energy and Climate Change (DECC) considers this territory as "the most promising location for shale gas extraction" (Regeneris, 2011).

Cuadrilla so far has had no rival of the same size and means in Britain. The business landscape is highly concentrated. With one big player, the market is lacking competition. The most basic business theory describes competition as an engine for increased innovation. Innovation can be considered as outstandingly important for an industry that is currently still in the exploration phases and is facing a strong need for further technical development. Those developments should especially focus on decreasing the environmental impact of fracking. Moreover, strong competition is considered as a market condition that decreases price (n.a., 2013b).

That extracting and utilizing shale gas in the UK could drive down energy costs, although constantly questioned, is one of the main arguments used by shale gas advocates (The Guardian, 2013). Stronger market rivalry could be a factor to bring this advantage of shale gas alive. Perhaps the recent Dart Energy-GDF Suez alliance will change dynamics. In contrast, the NGOs' perspective towards this point is negative. They cited a report from Deutsch Bank to argue that "those waiting for a shale-gas 'revolution' outside the U.S" to cut the energy bill in EU will likely be disappointed (Bosworth, N.A.).

For all its pioneering reputation, Cuadrilla Resources ran went into trouble in 2011. A series of tremors near Blackpool were linked to a Cuadrilla shale drilling site (Macalister, 2013). The fear of being held accountable for this incidence led the firm suspend drilling (BBC, 2011). In public, Cuadrilla admitted that its operation caused those tremors (White, 2011). Cuadrillas's advisers and a government expert panel said, however, that the tremors were not at a level that could have caused any material damage in its surrounding (n.a., 2012). Nevertheless those fracking repercussions led to consequences. The government decided to issue a temporary moratorium on fracking. (Richards & Fell, 2013).

The fracking ban merely existed for a year. It was lifted in December 2012 (Webb, 2012). Environmental concerns and opposition grew stronger. The government, as mentioned, created a "traffic light" system to closely check on seismic activity. Cuadrilla Resources also felt the need to calm the opposition's hard feelings. To prove that fracking can be conducted in an "environmentally and socially sustainable manner" (n.a, 2013a) without serious tremors and especially water contamination, the firm currently runs environmental impact assessments for each exploration well site (ibid. 2013).

Cuadrilla's increased environmental assessment efforts should also be seen in context of overall industry strategy to keep its social licence to operate. The UK Onshore Operators Group (UKOOG), the representative body of the industry, stated in February 2013 that "voluntary guidelines will help industry show it can 'access shale in an environmentally sensitive but also economic way'" (Macalister, 2013).

This approach is a response to ongoing protests from the environmental movement. UKOOG has strongly increased its public relations effort and is coordinating industry standards on green and community concerns. The group clearly states that those guidelines, with a strong focus on chemicals used during the fracking process, are a cornerstone of the industry's attempt to positively contribute to the economy, creating jobs and energy supply while working in cooperation with communities in a safe and environmental manner. The voluntary guidelines, with the aim to create environmentally benign operations, are not binding for companies. They can be considered as a measure of best practice but do not keep any company from adhering to alternative environmental protection and safety approaches (UK Onshore Operators Group, 2013).

The guidelines give the impression of extending the government's regulatory system, filling in the gaps, building a backup and suggesting rule for operating near densely populated areas. Energy Minister John Hayes welcomed UKOOG voluntary guidelines of the onshore gas industry as complementary to the governmental regulatory system (Macalister, 2013). UKOOG has also moved to develop rules for improved community engagement to better communicate with local stakeholders.

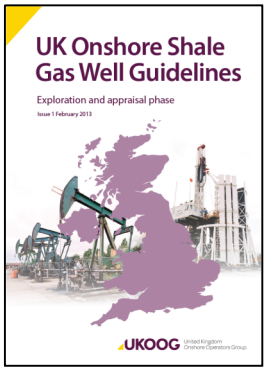

Figure 1. Online communications of the UKOOG interest group, guidelines and Community Engagement Charter (2013).

UKOOG United Kingdom Onshore Operators Group

Community Engagement Charter (2013)

What we will do

- Conduct operations in accordance with good industry practice, UKOOG guidelines and applicable legislation and regulation;
- Put safety first: take necessary steps to minimise any risks of injury to persons or damage to property;
- Protect the environment: ensure effective risk-based, systematic, management of environmental impact;
- Operate in accordance with effective management systems and ensure that personnel are competent in the tasks they are required to do;
- Engage with individuals and organisations in the local communities from an early stage;
- Monitor and evaluate the engagement process regularly;
- Provide benefits to local communities at the exploration/ appraisal stage of £100,000 per well site where hydraulic fracturing takes place;
- Provide a share of proceeds at production stage of 1% of revenues, allocated approximately 2/3rd to the local community and 1/3rd at the county level;
- Keep this charter and our interaction with local communities under review, including consulting communities about it from time to time, in the light of operating experience.

Toward the Next Level

The Cuadrilla-Centrica and the Dart Energy-GDF Suez deals might be events that could incentivise other big oil and gas companies to invest in order to avoid missing out on a huge business opportunity. The market obviously has some trust even in smaller operators like iGas, which set out to begin shale gas operations in late 2013(Nimmo, 2013).The company is experienced in onshore energy and is listed on the London Stock Exchange's international market for smaller growing companies, called Alternative Investment Market(AIM). (London Stock Exchange, 2013). iGas was able to raise £23 million in January 2013 from a share placing, in order to finance the estimated £15 million cost to drill two wells in North-West England (Griffiths,2013).

The government's tax incentives for shale gas exploration are supposed to promote early investments and, according to Chancellor George Osborne, should illustrate that shale gas is "part of the future" (Gosdon, 2013). Tax breaks make sense as high initial losses are probable. Cuadrilla, for instance, reported losses of £8 million in 2011 and £12 million in 2010 (Griffiths, 2013).

Tax breaks increase the likelihood of new players in the market, and that can be considered a strategic step; they also benefit not only shale gas investors but also those going for coalbed methane, another important type of unconventional gas (Griffiths, 2013).

The government, just as the industry, has understood that environmental and safety rules take high priority. New rules have been created from seismic and groundwater monitoring requirements to frac-fluid control and flow-back standards (n.a., 2012). It is likely the regulatory regime will receive further add-ons and has to be adjusted as new technology and experience emerges.

To some degrees, outside experts claim that government and industry shall share the authority for risk mitigation caused by fracking activities (Resources for the Future, 2013).

A considerable discussion in Britain has centered on what unconventional gas development will mean for local communities. Many affected communities are in opposition to fracking in their neighbourhood, or unsure and doubting what E&P brings to their municipalities except disturbance, disruption and risk. "What's in it for us," many ask, and that is a legitimate question. The government is planning to offer citizens financial benefits in the form of tax breaks on energy bills (Philipson, 2013).

Moreover, communities accepting fracking on their territory may also get privileged funding for infrastructure such as new community and sports complexes. Ideas to construct concrete "community benefits" are being collected to convince citizens in Northwest and Southeast England to indulge a positive attitude.

In the House of Commons, further steps have been suggested. According to a select committee report, communities "should expect to receive and share in, some of the benefits of development," and government is planning to have companies compensate communities with £100,000 for each fracked well plus one percent of revenues as soon as the actual production starts. Operators would furthermore be mandated to disclose how they have met their commitment each year (Natural Gas Europe, 2013).

Companies and government still have to fear a growingly active, networked opposition movement with high media impact. In the summer of 2013, for two months national debate over fracking centered on protest events in the Sussex village of Balcombe, where Cuadrilla drilled for oil. Even though the firm said it had no intention to frack there, protest camps and blockades were set up, and for demonstrations up to 2,000 environmentalists and anti-fracking activists descended on the rural hamlet. Intensive media coverage ensued over the protests with heavy police presence and many confrontations, leading to arrests of more than 100 people, including even a member of parliament. Police expenses could be as high as £4 million, it was reported (Taylor & Harvey, 2013; Guardian, 2013).

The Balcombe experience may have been the beginning of a more militant movement which may flare up at many future drilling sites, giving the young industry and the ambitious government a serious challenge. Political controversies about the threats of the technology are far from over, and a consensus of public acceptance still has to be engineered.

Conclusion

If estimates prove correct, the UK has a huge quantity of shale gas hidden in its grounds. Developing it is an opportunity to slow down or even halt Britain's increasing reliance on foreign gas resources in the face of declining North Sea offshore production – gas that is used to keep industry running and households heated. Britain has, of course, climate emission targets to keep, and this fossil fuel must be considered a transition helper.

The UK also grows its renewable energy supply and invests in new nuclear reactors. But to totally neglect the "home-grown" alternative of unconventional natural gas would be simply irresponsible towards upcoming generations.

Prospects for the future of UK gas do have stumbling stones in front of them. In a market view, there are currently not enough companies operating. Without the existence of a competitive market, the likelihood of innovations is limited. Innovation is necessary to reduce fracking impacts on the environment, heavily criticized by many citizens. Environmental concerns are a key issue.

The British government so far has not been able to elaborate a fully satisfying regulatory system. To add, knowledge about environmental, technical and economic impacts of fracking is limited, and more research is needed. The community benefits question is also not yet settled.

The British administration is putting a lot of effort into eliminating those barriers. Industry is also moving forward with better environmental standards, guidelines, stakeholder and community engagement approaches. If the country is successful in resolving these issues, it might be able to assure that modern technology can be used efficiently and without too many impediments in order to establish shale gas a substantial part of the UK's energy mix.

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